BULLETIN NO. 203

Blawforms for Light Walls and Foundations

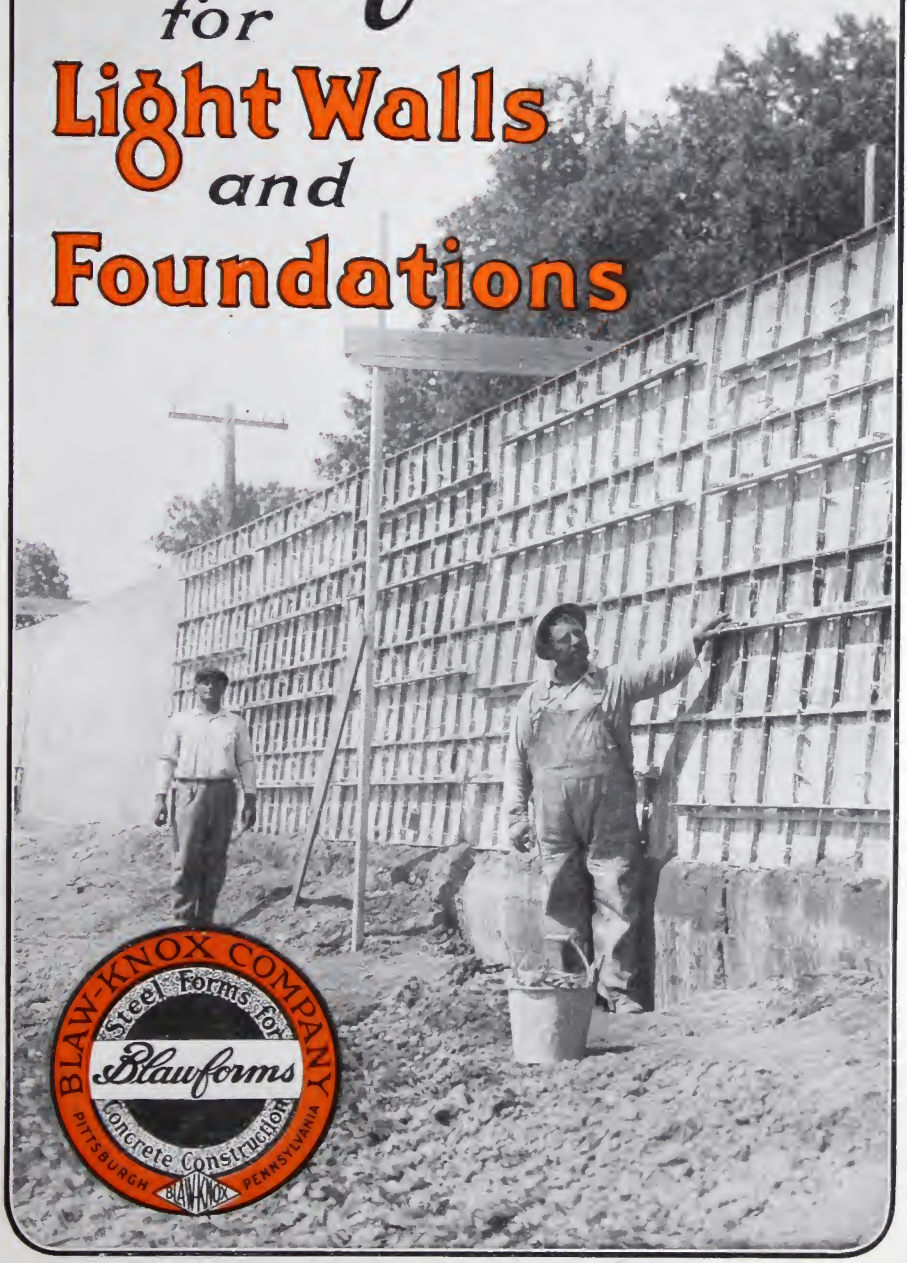


Fig. 1. Blaw Light Wall Forms used in building the foundations of 1000 and 750 industrial-village houses at Flint and Pontiac, Mich., respectively. General Motors Company, owners.

LABOR and lumber are scarce and steadily mounting in price. The only available means of reducing the cost of construction is to eliminate waste of materials, and to give the workman facilities by which he may accomplish more with less effort.

Blawforms eliminate all waste of materials. These forms cannot warp, shrink, crack, leak, nor wear out in use; they are practically indestructible. They absorb no oil. No concrete is lost, the forms present a smooth surface, and maintain uniform wall thicknesses.

Blawforms are the modern facilities which enable the workman to accomplish more with less effort. These forms are assembled and handled more rapidly and more easily than ordinary forms. They make it possible to complete a job in less time and with a smaller amount of form surface. The very minimum number of skilled men is required; ordinary laborers, properly instructed at the beginning of the job, handle these forms with more economical results than skilled laborers handle wood forms. Less labor is required in "pointing up," because Blawforms assure perfect alignment and present a smooth surface to the concrete.

The savings effected by the use of Blawforms are always positive, the amount being governed only by local material and labor conditions.

This Bulletin is issued merely to explain the advantages of the forms, to show (by means of illustrations of but a few of the thousands of jobs on which they were used) the great variety of work to which they are adapted, and to describe in detail the method of assembling and applying them to various types of construction—we shall be pleased to take up with you the application of Blawforms to your peculiar problems.

Fig. 2. Railroad Coaling Station built with Blaw Light Wall Forms by Fairbanks, Morse & Co., Chicago. Other similar stations have been built by this firm, using the same equipment of Blawforms

BLAW Light Wall Forms are built entirely of steel—there is no lumber attached, to warp, swell or crack. The basis of these forms is a number of steel plate panels, each two feet square, reinforced with steel angles on all four sides and through the center, and weighing about 22 pounds each.

The panels are connected and held in alignment by means of liners, keys and ties. Fractional panels, lap panels, and corner panels are used for adjusting the forms to the proper length between corners, and to provide for various wall thicknesses.

The liners, which are made of steel angles, serve a triple purpose; namely, they hold the panels absolutely rigid, make it possible to move the forms in large units, and provide the means of quickly and accurately lining up the forms.

Wedge shaped keys are used for joining panels together, for attaching liners, and for securing spacers or ties. These keys are all exactly alike, being easily secured in place, or removed, by a blow of a hammer —they stay placed until intentionally removed by the workmen.

When wire ties are employed they are made up on a frame furnished for that purpose, before the forms are set up. Thus the ties are made much more cheaply, and exactly of the same length and strength, insuring perfect uniformity of wall thickness.

Blawforms for Light Walls and Foundations have been in successful commercial use for over ten years, and while our engineers have been able to effect some minor improvements, particularly with reference to the fasteners and liners, *the design has not been materially changed in all that time.*

These forms may be either purchased or leased. For miscellaneous work such as foundation construction or house building, we recommend the purchase of a suitable outfit of moderate size, because, being practically indestructible and readily adapted to a wide range of work, the forms can be used over and over again for many years. For the larger jobs it is usually more economical to lease the necessary forms.

Fig. 3 Blaw Light Wall Forms used in the construction of a square bin concrete elevator at Morris, Ill., by the Younglove Construction Company of Sioux City, Iowa

BLAWFORMS for Light Walls and Foundations are adaptable to a very wide range of work. They are peculiarly suited to the construction of retaining walls, foundations and superstructures, but have found wide application upon many other kinds of structures such as grain elevators, coaling stations, sewage purification works, baffle walls in reservoirs, side walls of tunnels and sewers, and the walls of circular tanks.

For houses and other buildings, Blawforms are provided with standard corner connections, adjustable and adaptable for walls of any thickness and length, and useful in constructing chimneys. These devices do not interfere in any way with the regular system of spacers or ties, or with the use of liners. An equipment for one foundation job may be used on any other, as it is made up entirely of standard parts.

Blawforms are equally well *adapted to large or small jobs*. Other forms are more limited in their scope; they either require that the concrete be deposited too slowly (as to depth) to suit the convenience of the contractor, make too many operations and consume too much time to complete the work at each point, and so are unsuitable for large work, or they demand a method of handling that is correspondingly undesirable on a small job because it demands too much equipment. Blawforms may be used to pour concrete two feet or ten feet deep at an operation *with equal facility* employing the most economical methods in both instances.

We offer the services of a corps of experts in form design and handling. On large jobs, while employing standard forms and principles of design (protected by our many patents), we lay out the equipment so as to secure every possible advantage to the contractor in the matter of economy on the special job which he has in hand at the time.

Blawforms have been used on thousands of contracts which take in many of the largest and most important ones on record.

The illustrations in this Bulletin have been selected to show the wide range of adaptability of Blawforms for Light Walls and Foundations. They eliminate all waste of materials, produce perfect walls, and cost less to handle than other forms. The work involved in handling them on ordinary walls is, on the average, including lining up, removing, oiling, and all expense connected with the form work, about one-half that of wood forms; and skilled labor, except to direct the work, is not necessary. They are profitable *equipment*, not wasteful *materials*. As they are set up and shifted much more rapidly than ordinary forms, a smaller outfit will do the same work in less time.

Fig. 4. Blaw Light Wall Forms in use on foundations for Fine Arts Museum, New York City
P. F. Kenny Co., contractors. Four courses of panels in use

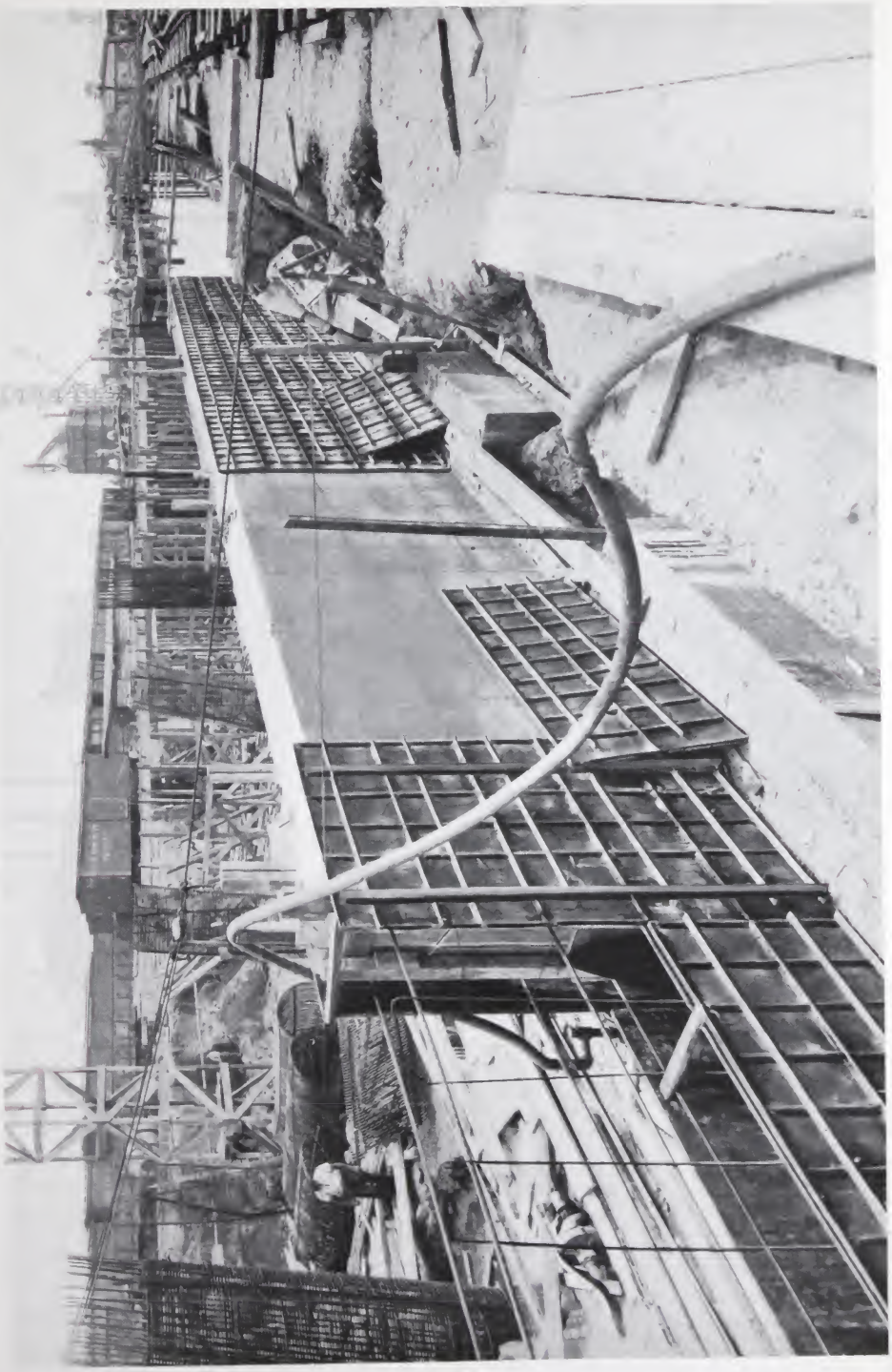


Fig. 5. Blaw Light Wall Forms; freight station, Pennsylvania Railroad, Philadelphia
Turner Concrete Steel Company, contractors

Fig. 6. Blaw Light Wall Forms on Merchants and Planters Compress and Warehouse Company's plant, Galveston, Texas

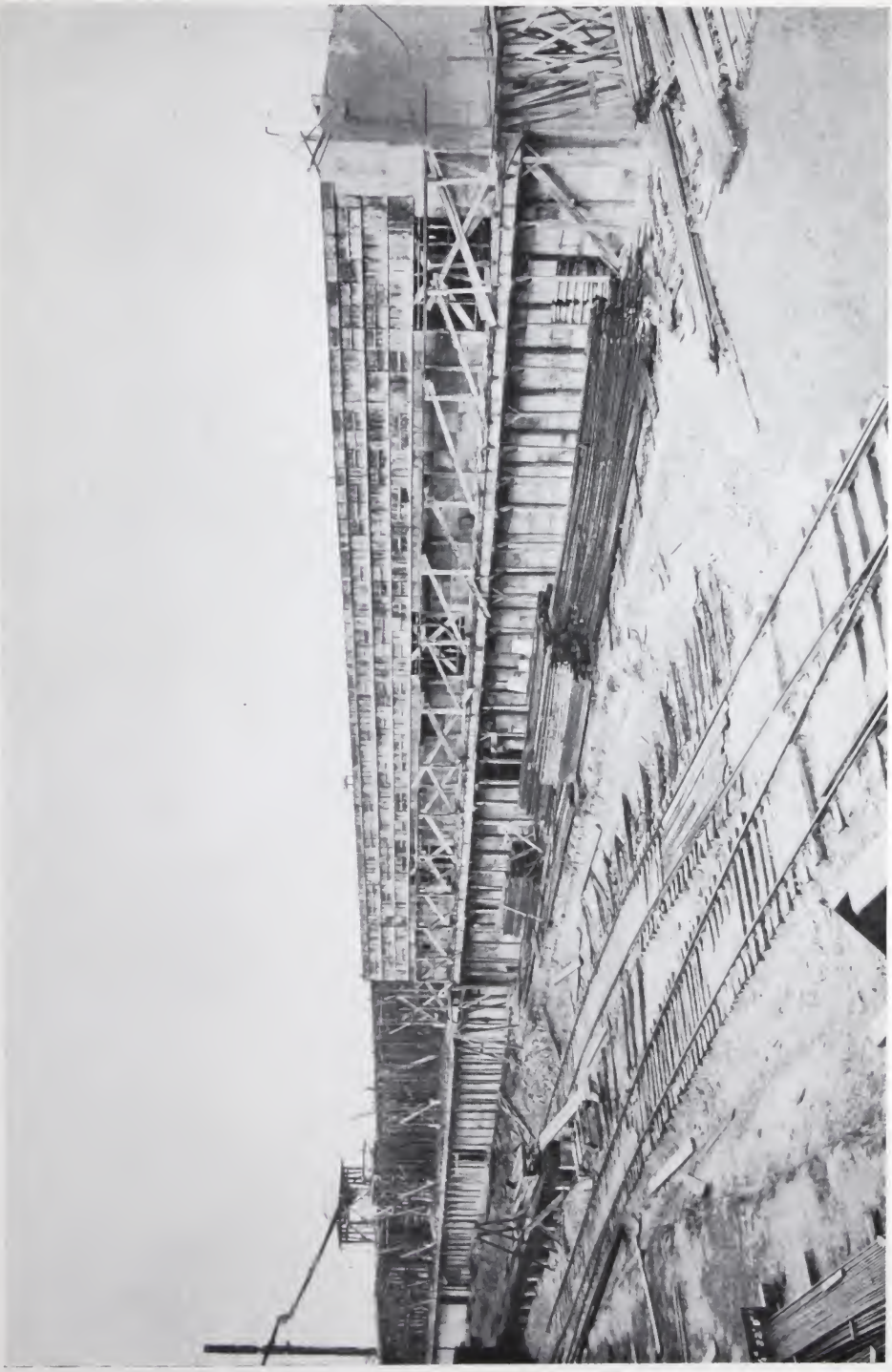


Fig. 7. Blaw Light Wall Forms on walls of Merchants Compress, Houston, Texas
James Stewart & Co., Inc., contractors, St. Louis, Mo.

Fig. 8. Blaw Light Wall Forms were used in the construction of this wall for the American Radiator Company
The John W. Cowper Company, Buffalo, N. Y., contractors and engineers

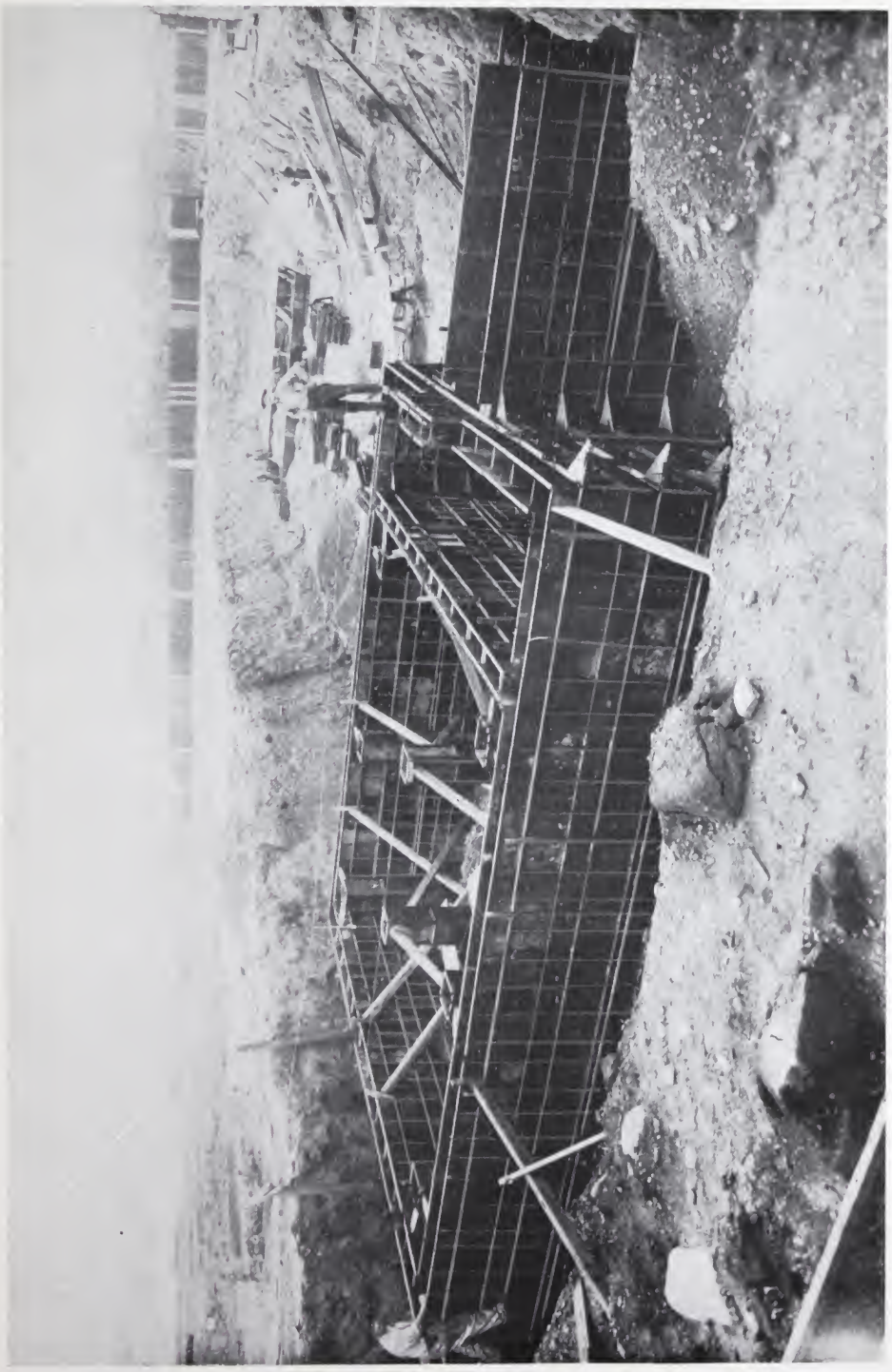


Fig. 9. Blaw Light Wall Forms on the Frankford Arsenal dry houses, Philadelphia, Pa.
Ketcham and McQuade, contractors

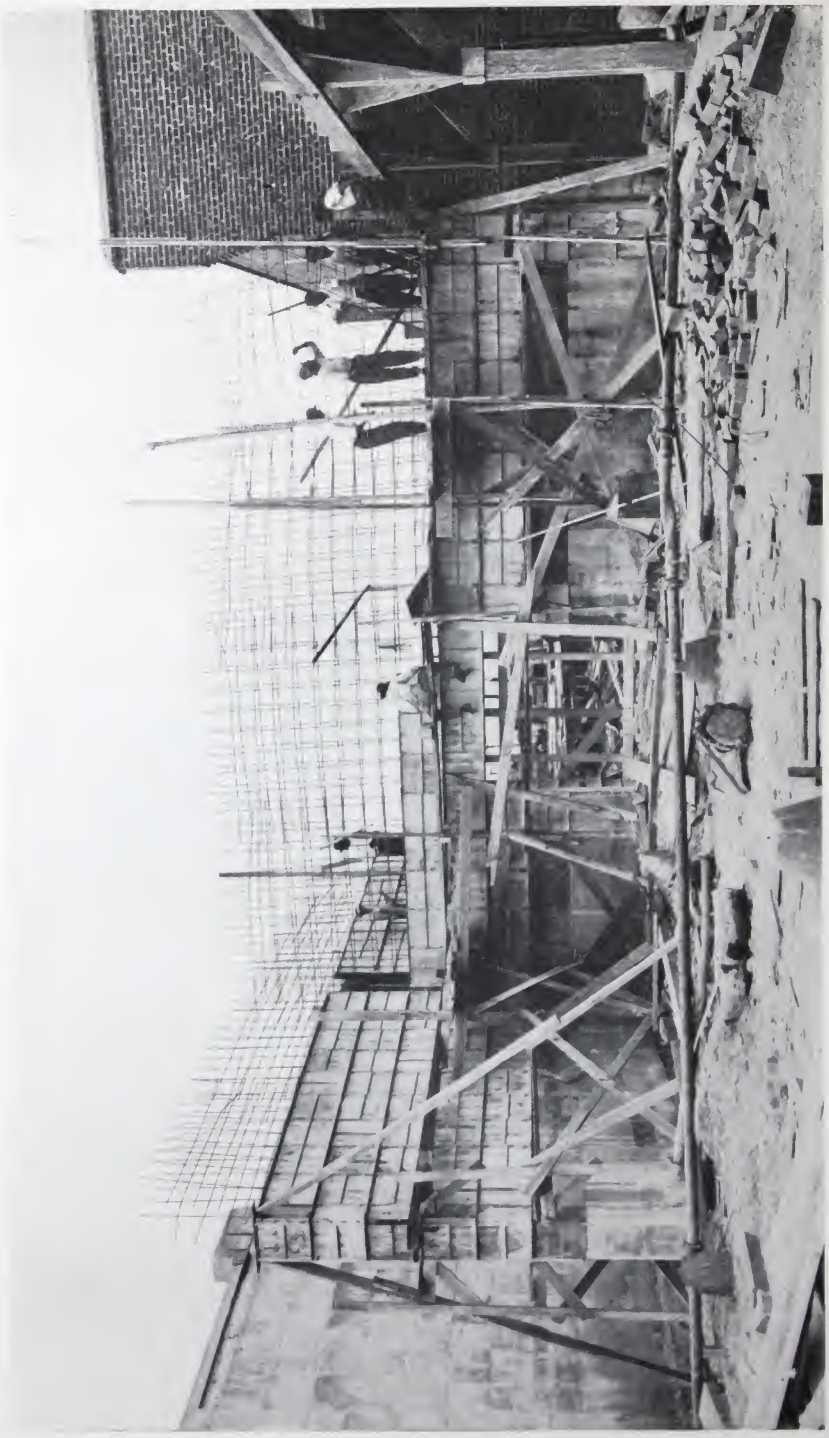


Fig. 10. Blaw Light Wall Forms used by the Fairbanks, Morse Company

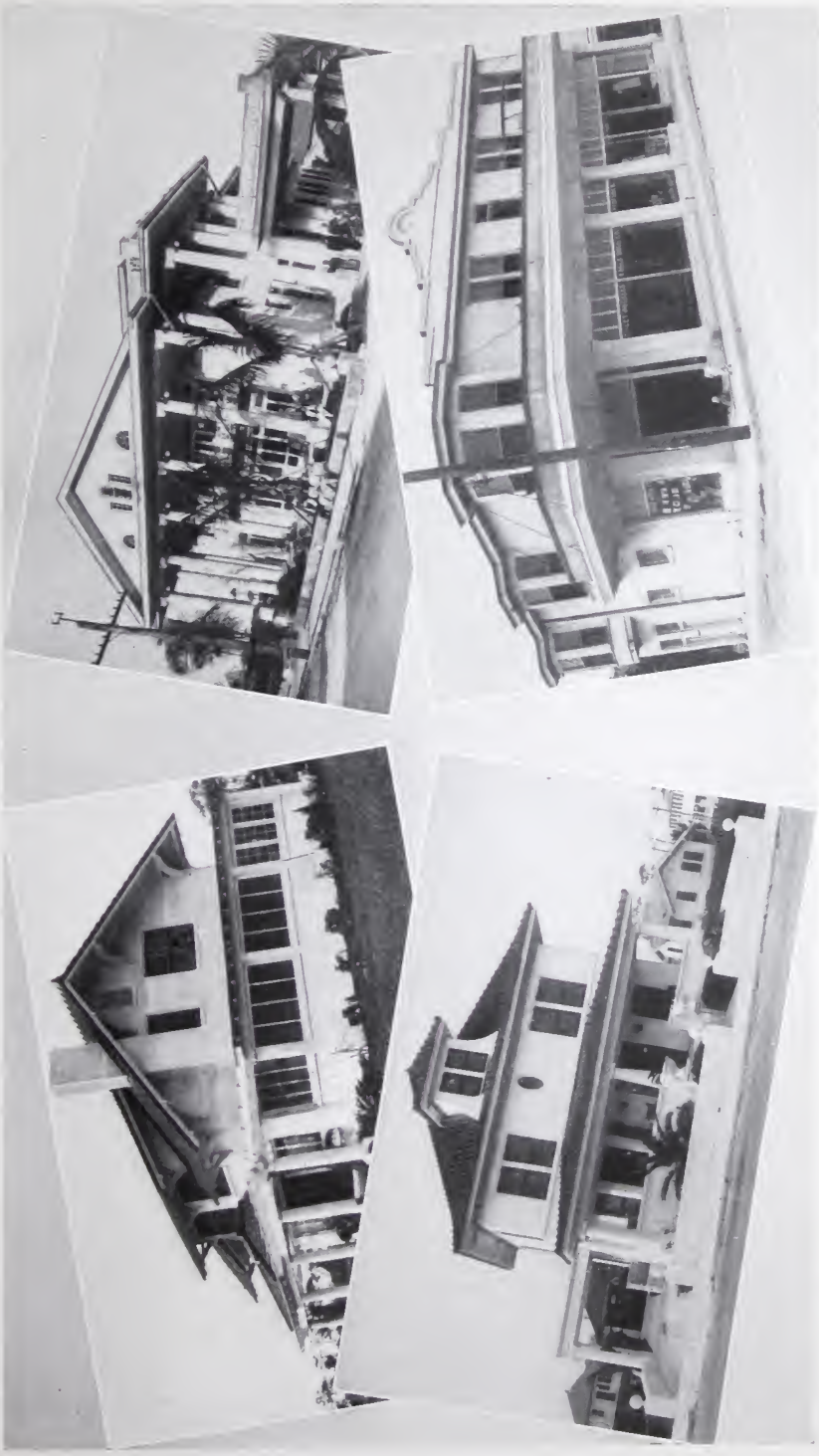


Fig. 11. Blaw Light Wall Forms were used in the construction of these and other buildings in Miami, Florida
George W. Clark, contractor

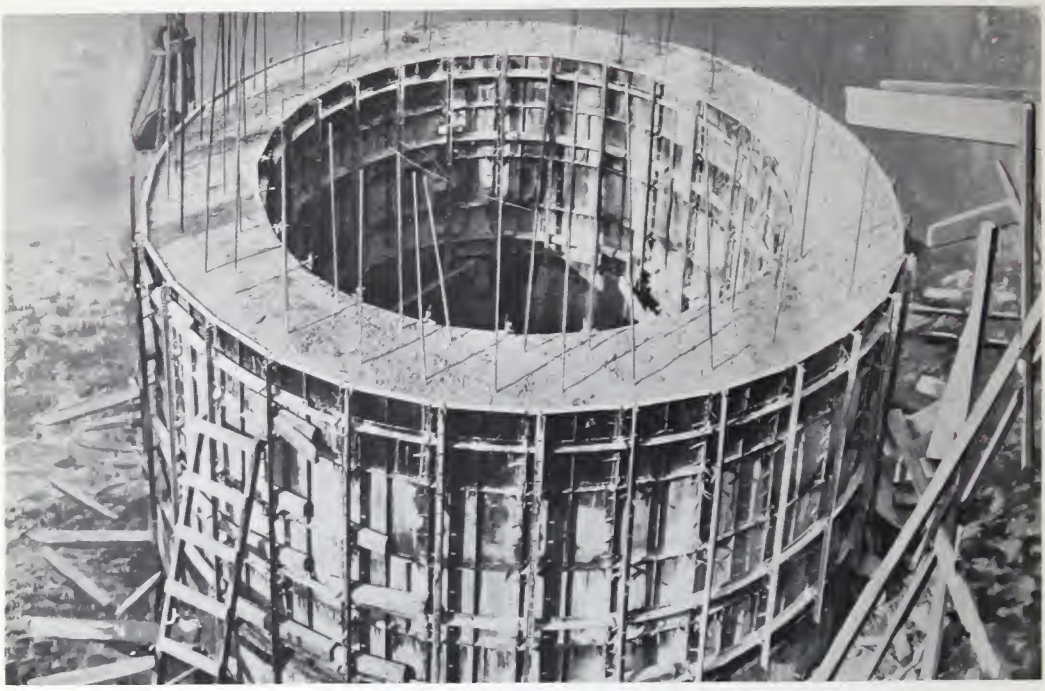


Fig. 12. Blaw Light Wall Forms on circular caisson construction for Pittsburgh Spring Steel Company. Pihl and Miller, contractors

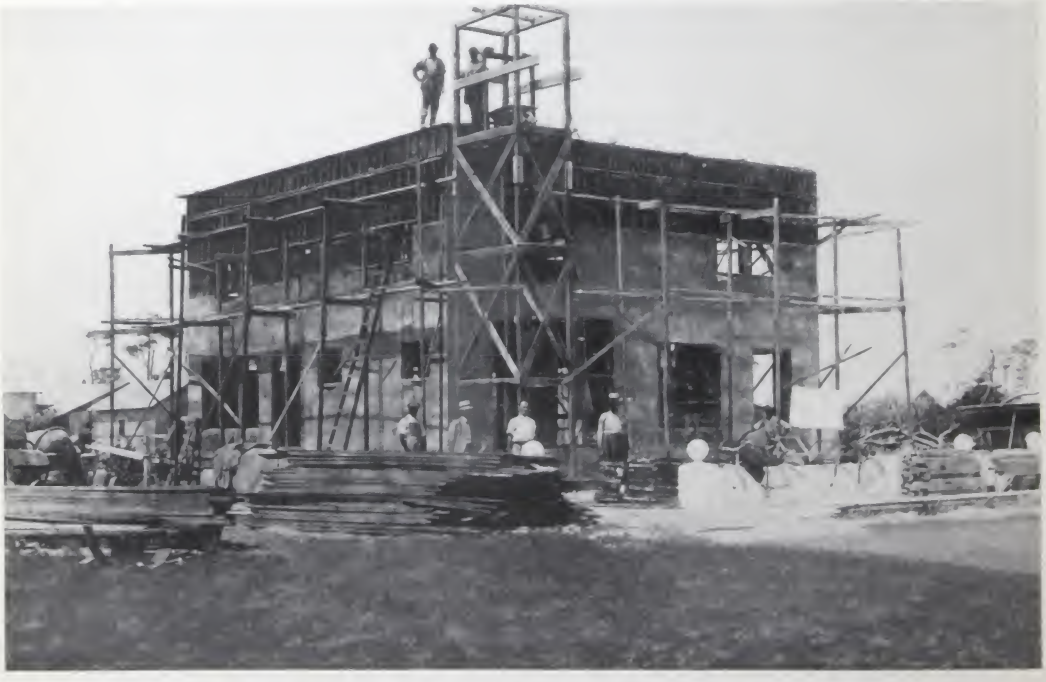


Fig. 13. Blaw Light Wall Forms, three course method, Miami, Florida George W. Clark, contractor

Fig. 14. Blaw Light Wall Forms on house foundations, Hartford, Conn. H. E. Putnam, contractor

Fig. 15. Blaw Light Wall Forms on foundations at Mill Creek Naval Station

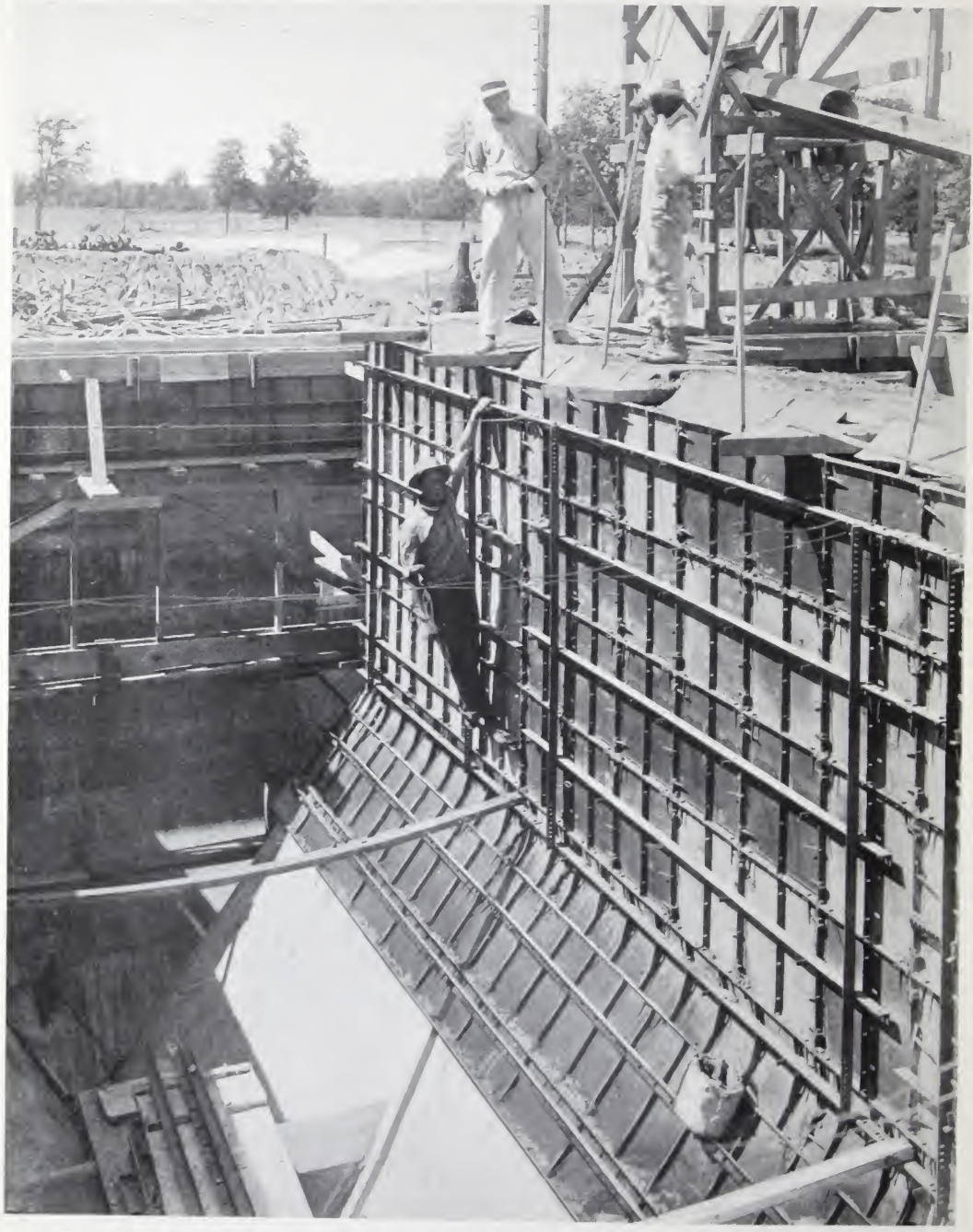


Fig. 16. Blaw Light Wall Forms on sewage disposal plant construction, Dallas, Texas

AS stated previously, Blawforms for Light Walls and Foundations consist of standard panels, two feet square, with means for connecting these panels and of keeping them in line, also of fractional panels, lap panels, and corner panels, suitable for adjusting the forms to the proper length between corners and for providing various wall thicknesses. The number of kinds of parts is few, and the connections very simple. The forms are the most adaptable steel forms obtainable, being readily applied to a very great variety of conditions.

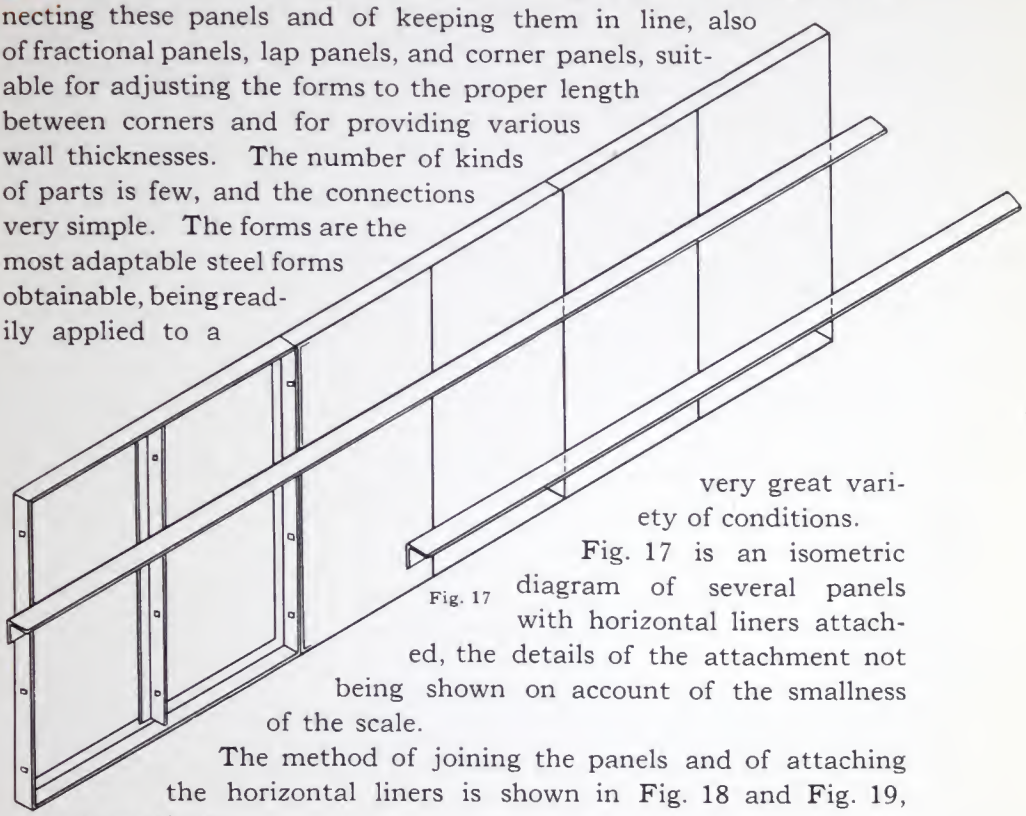


Fig. 17

Fig. 17 is an isometric diagram of several panels with horizontal liners attached, the details of the attachment not being shown on account of the smallness of the scale.

The method of joining the panels and of attaching the horizontal liners is shown in Fig. 18 and Fig. 19, respectively.

When these forms are to be shifted by hand they are usually assembled in single courses two feet high (the height of the panels), in units containing not more than twenty-four square feet of surface. As the horizontal liners ordinarily furnished are eleven feet six inches long, not more than six panels (which are two feet square) can be attached to each liner. In any event, each unit, no matter what amount of surface it contains, should have one horizontal liner.

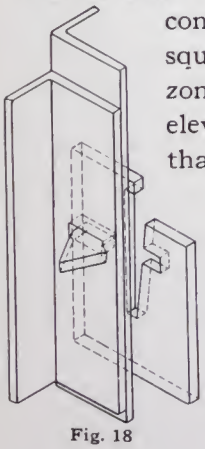


Fig. 18

Any number of such units can be used, one above the other, as indicated in Fig. 21. Fig. 20 is

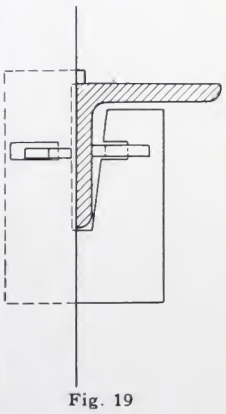


Fig. 19

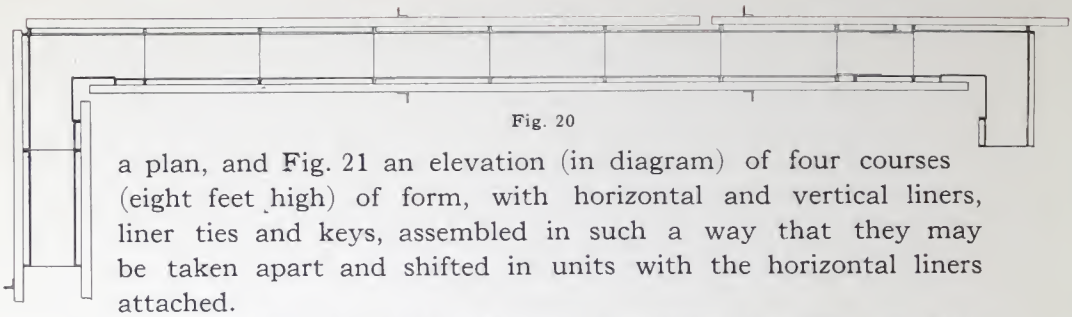


Fig. 20

a plan, and Fig. 21 an elevation (in diagram) of four courses (eight feet high) of form, with horizontal and vertical liners, liner ties and keys, assembled in such a way that they may be taken apart and shifted in units with the horizontal liners attached.

In general, the method of assembling the form is the same, whether two, three, four or five courses are used.

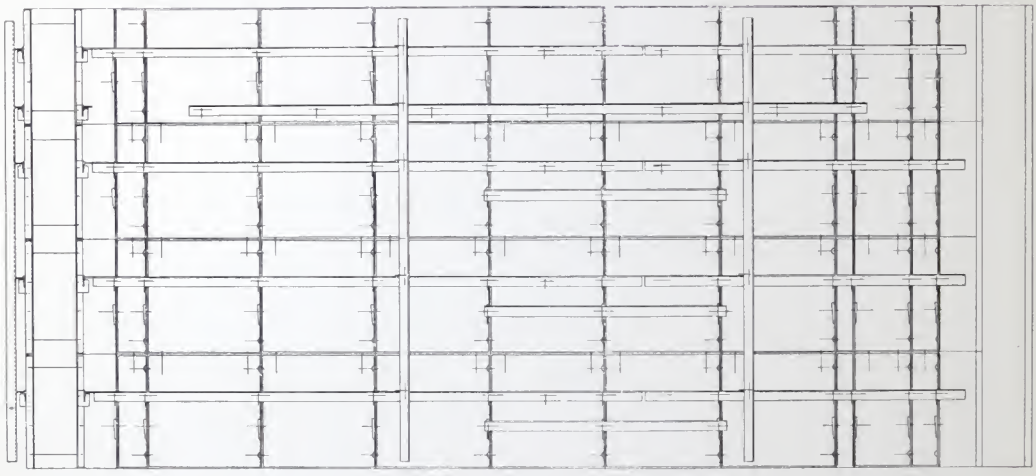


Fig. 21

A detail of the attachment of the vertical liners is shown in Fig. 22 It is simple, easily attached and positive in insuring good vertical alignment of the panels. An extra horizontal liner is attached to any one of the courses (the top course in Fig. 21) to give a bearing for the vertical liners. This extra horizontal liner is attached by liner ties to the middle angles of the panels so as not to interfere with the placing of wire ties.

The vertical liners are placed six or eight feet apart, as conditions may demand; and the fastenings required are about equivalent to one liner tie and

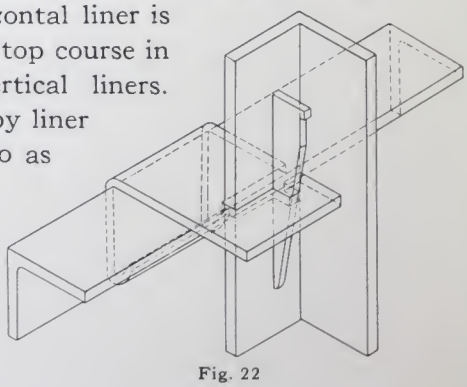


Fig. 22

one key to every twelve square feet of form, the labor of placing these being almost negligible.

Assembled in this way, with a No. 12 tie wire in every place provided, the form is strong enough to be filled with wet concrete for a height of eight feet in one hour, or ten feet in two hours. The lower tie wire in the top course may be omitted at the top portion of the wall; but it is necessary, if the top course is to remain in place, to support the other courses, in case the forms are to be shifted upwards.

The tie wires are inserted in recesses between the panels formed by crimping the angle which forms the side of the panel and coping out a narrow strip of the plate. The wires are held by keys which pass through the slots in the flanges of adjacent panels.

Wire ties are placed for each course as the form is erected.

One horizontal liner tie and one key connect two panels and attach a liner.

The vertical liners are usually attached last, but may be placed at any time earlier if preferred.

Fig. 23

The wire ties used to keep the form from spreading are made upon a tie making machine which may be adjusted to produce ties of any desired length. This machine is illustrated in Fig. 23, and the preferred style of tie made upon it is shown in Fig. 24. No. 12 annealed iron wire is usually employed for ties, but No. 10 may be used if desired. Wire larger than No. 10 cannot be used. No. 14 wire is strong enough only when concrete is poured to a height of four feet, or less, at one operation.

To use the style of tie shown in Fig. 24 it is necessary to place the ties in each course of panels before placing a course of panels above, as a man must reach down between the opposing panels to insert the tie. This tie cannot be pushed through from the outside. Care must be exercised to place all of the ties as the forms are erected. If however a tie should be omitted, one may be inserted from the outside by making it as shown in Fig. 25, this tie being slenderer than the preferred one.

When the form is removed, the short loops of wire project about an inch and a quarter from the face of the wall. They are inconspicuous, and on foundation walls are usually left, but on superstructure walls the loops are cut off flush with the concrete surface by end cutters or nippers. The presence of these wire ties in the wall will not cause leaks; but if leaving a tie in the wall is objectionable, the wall may be poured without ties in courses two feet high, as shown in Figs. 28 to 31.

Fig. 24

Fig 25

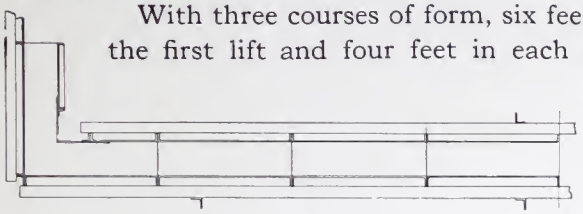
Wire ties may be made for walls of any thickness, by adjusting the tie machine.

When wire ties are used the cheapest method of handling the form is to set up two courses (four feet high) around such portion of the wall as it is desired to build at one time, and to fill this form to the top—that is, pour the wall four feet high. The lower or first course is then removed and placed above, becoming a third course. When this third course, 2 feet high, is filled, the second course is raised, becoming the fourth course, the work thus proceeding in two foot lifts until the necessary height is attained. This method is the cheapest for the following reasons: (a) it requires a minimum quantity of form; (b) it is cheaper to shift upward a course of panels already assembled than to assemble forms for another course; (c) the form being used a greater number of times before being transported or carried laterally to another part of the work (or another building), the cost of transporting and distributing the form is at minimum; (d) No. 14 tie wires can be used, instead of No. 12 otherwise required, resulting in a saving of wire.

We therefore recommend the use of the two course method (pouring a height of four feet each day, two in the morning and two in the afternoon) on all work where, on account of the concrete placing equipment, greater progress is not essential.

The two course method, with ties of No. 14 wire, is especially adapted to the construction of concrete houses which are to be given a coat of stucco or other finish after the ends of the tie wires are clipped. It is decidedly the cheapest method of building sound concrete walls for small buildings. The two course method *without ties,* illustrated in Figs. 28 to 31, is preferable if the walls are not to be covered with stucco, as it eliminates staining of walls due to corrosion of tie wires.

On the other hand, it costs a little more to place concrete in two foot lifts than to pour six, eight or ten feet at a time, especially, where the mixing and concrete distributing plant is of large capacity.



With three courses of form, six feet of concrete is poured in the first lift and four feet in each succeeding lift; with four courses, eight feet the first lift and six feet each succeeding lift; with five courses, ten feet the first lift and eight feet each succeeding lift. One course always remains in place to support the other courses, which are lifted, bodily, one course at a time in as long units as can be handled.

In case the form is to be handled in units attached to the horizontal liners, and not taken apart into separate panels each time it is shifted, it is put together, as shown in Fig. 21, firmly enough to stand repeated handling in units of not exceeding 24 square feet in one horizontal course. For each panel thus assembled there are required one liner tie and seven keys, including the two keys which pass through the loops of the tie wires. This is a remarkably small number of fasteners of the simplest kind, only two of which are required to be driven tight, the others being merely slipped loosely into place.

In case it is desired to set up the form for only one use without rearranging the panels, and it is not the intention to shift in large units with the liners attached, the keys joining the vertical flanges of the panels may be omitted and the panels connected as in Figs. 26 and 27. This requires fewer keys and permits the use of liners in random lengths, as they may be placed at different elevations on one course.

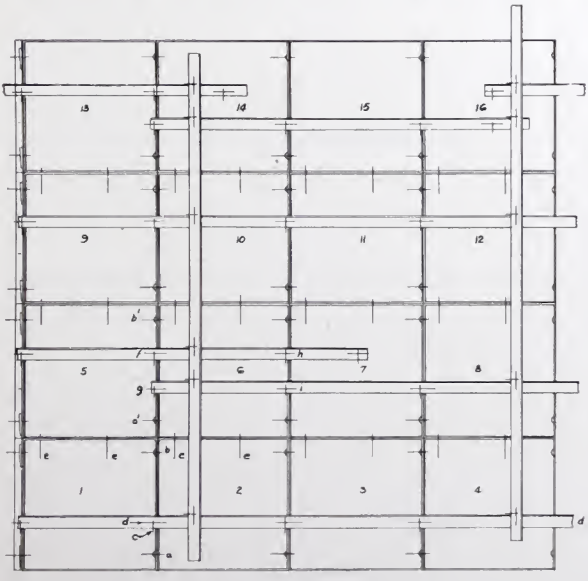


Fig. 27

The order of the steps in erecting the form

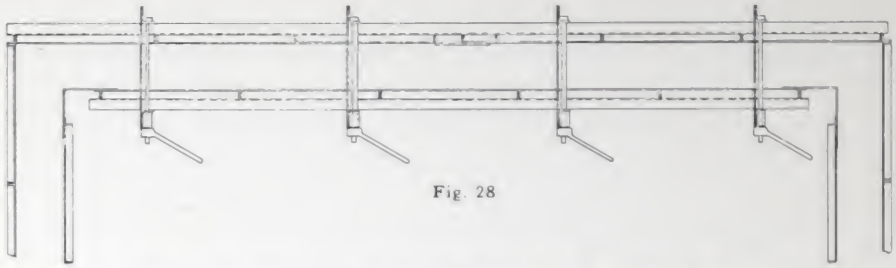


Fig. 28

shown in Figs. 26 and 27 is as follows: starting at the corner, place panel 1, attaching it to the corner angle by means of keys; place panel 2, insert wire ties and keys at a and b and place a liner tie at c; place panel 3 and panel 4 similarly, then place the horizontal liner and drive the keys d.

The second course is then erected on top of the first and held by keys e, a^1 and b^1, which latter also pass through the loops of the wire ties. The liners for the second course can be attached at either elevation f or g, or both, as may be most convenient. In placing any panel, as for instance panel 6, the keys are placed in the following order: e, e, b^1, a^1, and later, when the liner is inserted, at f, g, h and i.

When it is desired to pour a form without the necessity of using tie wires, this must be done in two foot courses, as illustrated in Figs. 28 to 31.

The first course of panels is assembled in the usual manner, with horizontal liners, liner ties and keys. Two horizontal liners are applied at different elevations in the first course (see Fig. 30). Only two liner ties and two keys are required for each panel in the course.

Opposing panels are kept the proper distance apart by spreaders cut to the proper length, as shown in Fig. 29. These are usually made of wood. The form is clamped about the spreaders by clamp yokes and tie bolts, the bolts passing above the top edges of the form as shown in Fig. 29 and Fig. 31.

As no ties go through the wall, it is not necessary to keep the joints in the panels opposite to one another; the plan is very simple, as illustrated in Fig. 28. The yokes are placed at convenient intervals, not exceeding four feet. They are supported upon the edges of the liners, as shown in Fig. 31.

Fig. 29

When the first course has been filled with concrete the yokes are loosened and raised, one at a time, and are then clamped in a higher position, that is, supported upon the upper horizontal liner of the first course.

The second course of panels is then placed, and the bottom angle on the first course raised and used on the second course, as shown in the middle section of Fig. 30. This liner is attached either at the top row of slots (3 inches from the top edge) or at the next lower row (9 inches from the top edge), as may be more convenient. By this means the

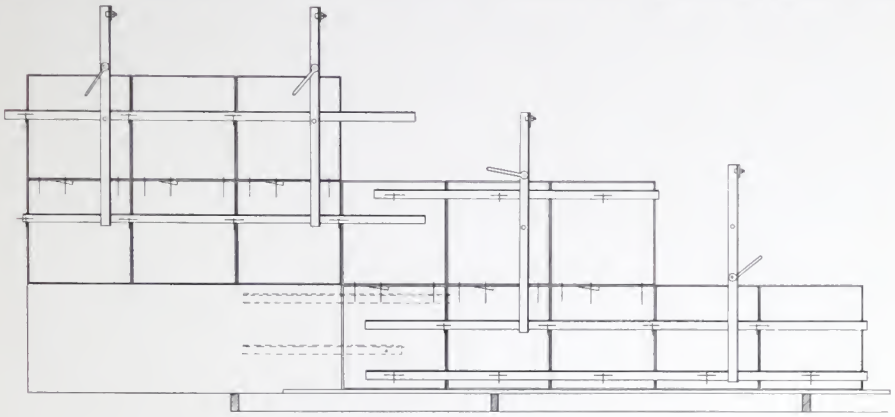


Fig. 30

liners may lap past one another to allow for variation in wall length. The bottom of the second course is secured to the top of the first course by keys.

After the second course is filled, the yokes are again raised, to the position shown in Fig. 31. The bottom course is then taken out and raised, one panel at a time. To raise each panel it is necessary to remove and to replace only one liner tie and five keys.

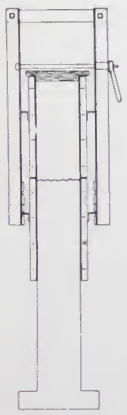


Fig. 31

Lining up is done to a line stretched from corner to corner of the building in the plane of the outside face of the wall immediately above the top of each course of panels. If the form leans a little to one side it can be pushed or pulled by hand to this line as the concrete is poured, and when the concrete is in, it will not move of its own accord.

For the walls of buildings, provision must be made for corners. On the outside, corner angles are used; on the inside "lap corners" provide for adjustment as to thickness of wall. The use of these parts, as well as of "fractional" panels and "lap" panels is shown diagrammatically in several of the figures. The "fractional" panels are made two feet high by six, twelve and eighteen inches wide. The "lap" panel is so made as to extend the

width of any panel to which it is attached—a variable amount, from three to nine inches, the adjustment having a range of six inches. As walls of buildings are of variable lengths, horizontal liners are furnished for such work in a variety of lengths less than the standard 11 feet 6 inches.

Blaw Light Wall Forms are frequently used in building engineering structures of rather complicated shape, such as reservoir walls with battered pilasters at regular intervals, battered retaining walls for circular tanks, side walls and aprons for Imhoff Tanks, etc. For such work it is usually best to provide some special panels for wall intersections, pilaster sides and tapered fillers; also, curved liners are necessary for circular walls. All such specials are designed to meet the requirements of the individual job, and are furnished at reasonable prices based upon the cost of production. If the specials required do not amount to more than twenty-five per cent of the total form surface needed for the work, it is found economical to provide and to use them in connection with standard forms, rather than to build special forms for the entire structure.

In this Bulletin we illustrate a few of the many construction jobs upon which Blaw Light Wall Forms have been used. These will give some idea as to the range of work upon which these forms can be applied to advantage. We have furnished equipments of all sizes, varying from 50 square feet for odd jobs on the farm to 50,000 square feet for the foundations of an industrial village. The quantity of form required depends upon the magnitude of the work in hand—the number of square feet of wall to be poured per day.

For foundations and the walls of houses, it is convenient to use a two course outfit entirely around the walls. As an aid to determining the size of equipment for constructing a building by this method, the following rule may be applied. Multiply the total distance around the outside of the foundation wall, in feet, by eight. The result is the total number of square feet of form that should be provided. The number of corners to be cared for should be specified.

For miscellaneous work, the following "outfits" are recommended:

General outfit for foundation work, walls of any thickness constructed with 1, 2, 3 or 4 courses of forms to one pouring.

Description	480 SQ. FT. Provides 2 courses for 60 lin. ft. of wall with 2 corners (about ½ of foundation of small house). Can be used for 40 lin. ft of 3 courses, or 20 lin. ft. of 4 courses		960 SQ. FT. Provides 2 courses for 120 lin. ft. of wall with 4 corners, or 3 courses for 90 lin. ft., or 4 courses for 60 lin. ft. with 2 corners		1200 SQ. FT. Provides 2 courses for 150 lin. ft. of wall with 6 corners, or 3 courses for 100 lin. ft. with 4 corners, or 4 courses for 75 lin. ft. with 3 corners	
	No.	Sq. Ft.	No	Sq. Ft.	No	Sq. Ft
Panels 24″ x 24″	98	392	196	784	234	936
" 24″ x 18″	12	36	24	72	36	108
" 24″ x 12″	12	24	24	48	36	72
" 24″ x 6″	12	12	24	24	36	36
Adjustable Lap Panels	8	8	16	16	24	24
" " Corners	4	8	8	16	12	24
Corner Angles	4	...	8	...	12	...
Liners 11′ 6″ lg	15	...	30	...	42	...
" 9′ 6″ "	15	...	30	...	48	...
" 7′ 6″	12	...	12	...	18	...
" 4′ 0″	14	...	28	...	40	...
Horizontal Ties	200	...	400	...	500	...
Vertical Ties	45	...	90	...	135	...
Keys	1600	...	3200	...	4000	...
Wire Twisting Mach.	1	...	1	...	1	...

Blaw Power Wheel Bucket installed on a Clyde Traction Crane, digging bank gravel for John Kleist Gravel Co., Milwaukee, Wis.

PRODUCTS OF THE BLAW-KNOX COMPANY

FABRICATED STEEL

Fabricated steel, one of the principal products of Blaw-Knox Company, includes mill buildings, manufacturing plants, bridges, crane runways, trusses and other construction of a highly fabricated nature.

A corps of highly trained engineers is maintained for consulting and designing services.

TRANSMISSION TOWERS

Four legged straight line or suspension towers, anchor and dead end towers, latticed and channel A-frames, river crossing towers, outdoor sub-stations, switching stations, signal towers, steel poles, derrick towers.

We specialize in the design and fabrication of high tension transmission lines.

PLATE WORK

Riveted, pressed and welded steel plate products of every description, including: accumulators, agitators, water boshes, annealing boxes, containers, digesters, filters, flumes, gear guards, kettles, ladles, pans, penstocks, air receivers, stacks, standpipes, miscellaneous tanks, miscellaneous blast furnace work, etc.

BLAW BUCKETS

Clamshell buckets and automatic cableway plants for digging and rehandling earth, sand, gravel, coal, ore, limestone, tin scrap, slag, cinders, fertilizers, rock products, etc.

For installation on derricks, overhead and locomotive cranes, monorails, dredges, steam shovels, ditchers, cableways, ships for handling cargo and coal, etc.

BLAWFORMS

Steel forms for every type of concrete construction: aqueducts, bridges, cisterns, columns, culverts, curbs and gutters, dams, factories, floors, foundations, houses, locks, manholes, piers, pipe, reservoirs, roads, sewers, shafts, sidewalks, subways, tanks, tunnels, viaducts, retaining walls, warehouses, etc.

FURNACE APPLIANCES

Knox patented water cooled doors, door frames, front and back wall coolers, ports, bulkheads, reversing valves, etc., for Open Hearth, Glass, and Copper Regenerative Furnaces; water-cooled standings, boshes and shields for Sheet and Tin Mills.

BLAW-KNOX COMPANY

GENERAL OFFICES—PITTSBURGH, PA.

DISTRICT SALES OFFICES

NEW YORK
165 Broadway

CHICAGO
Peoples Gas Bldg.

SAN FRANCISCO
Monadnock Bldg.

BOSTON
Little Bldg.

DETROIT
Lincoln Bldg.

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